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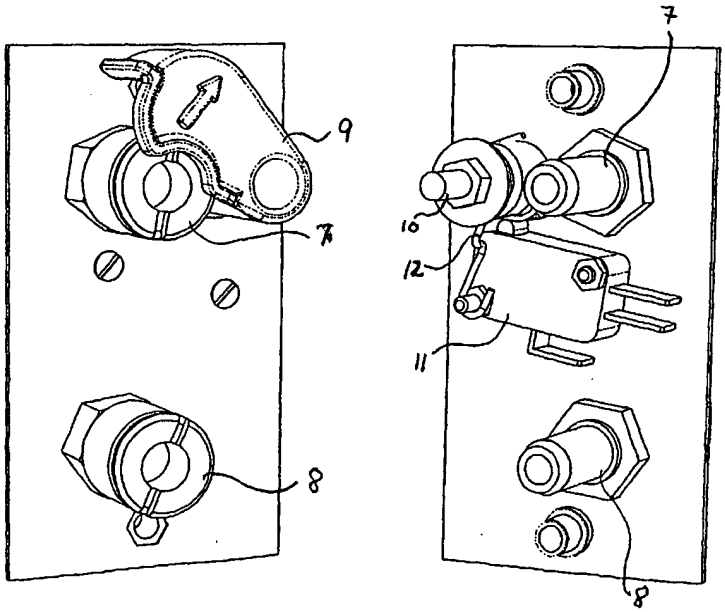
(54) **Title:** DEVICE FOR CONTROLLING THE COOLING POWER OF A COOLING APPARATUS



(57) **Abstract:** The present invention relates to an arrangement (9, 10, 11, 12) for controlling the cooling output from a cooling unit, intended to be arranged in and/or in immediate proximity to an attachment device and connected in signal terms to the control device for the cooling output, and further comprising, on the one hand, means (9) for detecting the presence or absence of the attachment nipple in the attachment device (7, 8) and, on the other hand, means for generating a signal corresponding to the detection result. The invention also relates to a cooling unit, an apparatus, a welding current source, and a wire feeder mechanism comprising such an arrangement.

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Device for controlling the cooling power of a cooling apparatus

Technical field

The present invention relates to an arrangement for controlling the cooling output from a cooling unit, and also to a cooling unit, an apparatus, a welding current source, and a wire feeder mechanism comprising such an arrangement.

Background

For a cooling unit which can be used alternately by different tools which can be attached to this unit and have mutually different cooling requirements, there is a need to be able to adapt the cooling output to the requirement of the tool which has just been coupled. This requirement may be due to temperature criteria critical for the process in which the tool is used. Other reasons for this requirement can include the working environment, where the noise level is to be minimized, or aspects of purely operational economy, where the aim is to increase the useful life of the apparatus. To illustrate the discussion, we take the example of a welding machine for electric arc welding:

In gas-metal arc welding, hereinafter referred to as MIG/MAG welding, the apparatus consists inter alia of a welding current source and wire feeder mechanism and also of a welding burner which can be attached to the current source and/or the wire feeder mechanism via a welding cable belonging to the burner. In addition, there is often also a cooling unit for cooling the welding burner and the welding cable belonging to the latter. The purpose of this cooling unit is to generate a forced cooling of welding cable and/or welding burner.

The welding cable which leads the welding current to the welding burner needs to be made small in order to permit maximum accessibility and mobility of the welding burner and to reduce the burden on the welder. On the other hand, the cable needs to be dimensioned for low voltage drop in order to avoid excessive heat development in it, given the often high currents used in MIG/MAG welding. This conflict is often resolved by having the welding cable surround the cooling tube which transports coolant between cooling unit and welding burner. The welding burner requires forced cooling when welding is carried out with great energy developed in the arc.

When welding is carried out with low currents and/or with low intermittence, i.e. with long intervals between the arc periods, use can often be made of a self-cooled welding burner, i.e. a burner which is cooled only by the surrounding air and protective gas flowing through it. Since a welding burner of this kind is lighter and smaller, these welding burners are preferred both for reasons of accessibility during the welding work in confined spaces and for reasons of comfort, since the burner and also the welding cable, which then does not need to contain cooling tubes, is lighter and reduces the risk of stress injuries to the welder.

From what has been stated above, it will be evident that situations can often arise where one and the same set-up of welding current source/wire feeder mechanism is alternately used for welding with a self-cooled burner and for welding with a burner with forced cooling.

Connection of the cooling tubes to the current source or wire feeder mechanism for supplying or returning coolant is often done with the aid of quick-couplings

with automatic stops to prevent the cooling medium from leaking out upon coupling or uncoupling of the tubes. Upon uncoupling of the tubes, the cooling pump will thus work against these stops and there is no circulation of the coolant. The pump is not normally dimensioned to work under such conditions. Some manufacturers therefore also supply a connection device for directly coupling together the two tube attachments on the current source or wire feeder mechanism in order to maintain the circulation even when the welding burner is not attached to the coolant circuit. A problem with this solution is that an additional attachment maneuver has to be performed upon each coupling and uncoupling of the cooling tubes. In addition, there is a risk of the small connection device being lost. A further problem is that the cooling pump will work the whole time regardless of whether the cooling output is needed or not. This leads to unnecessary wear on the pump and also to irritating and unnecessarily high noise levels.

Another solution to the problem is one in which a manual circuit breaker for the coolant pump has to be switched off when a welding burner of the self-cooled type is used. This affords advantages over the previous solution as regards wear and noise levels. However, the solution entails a risk that the pump will, through an oversight, not be restarted upon coupling of a cooled welding burner. This can then lead to the burner failing on account of overheating.

A third solution is based on a flow monitor in the coolant circuit which can detect the absence of a tool attached for cooling the unit and can then for example uncouple the coolant pump. However, for many types of apparatus, such a solution is too expensive to be practicable.

Of course, the cooling requirement varies also within the group of welding burners with forced cooling. In today's solutions, the cooling unit is therefore dimensioned for the greatest cooling requirement and also delivers this cooling independently of which burner is coupled to the coolant circuit at the time. This leads to unnecessary wear and to troublesome noise.

It has long been known to provide welding tools with identification means, such as a resistance whose value, representing the tool type, has been able to be read off by the welding apparatus to be attached. The welding apparatus has thus been able to adapt, for example, the maximum permissible output in accordance with the tool type. The cooling output too can be adapted in this way, as is described for example in WO 0044523.

A problem with such control of the cooling output is that electrical attachment of a welding burner is in most cases done completely separately from the attachment of the coolant loop. Thus, the identification of such a resistance code, for example, is no guarantee that the cooling output will be of use to the tool, since the cooling tubes may quite simply not be attached. The invention makes available a possibility of verifying that cooling tubes are attached.

Object of the invention

The object of the invention is to make available a solution to the problem of protecting the cooling unit and/or tool upon alternate attachment of self-cooled tools, and of tools with forced cooling, to the same apparatus, and to make available a method of limiting the wear and noises from the cooling unit upon

alternate attachment of tools with different cooling requirements, without the disadvantages inherent to the prior art.

The invention solves the problems in the manner specified in the characterizing clauses of the independent patent claims. Preferred embodiments are described in the dependent patent claims. For example, it is a further advantage, in an apparatus used in processes which generate dust and spatter, to provide the attachments for coolant with a guard which covers the attachment devices when no tool is attached to them. This prevents dirt from later being entrained with the coolant into narrow cooling channels in the tool.

Brief description of the drawing

Figure 1 shows a complete cooling unit intended for incorporation in a welding machine.

Figure 2 shows an attachment device for attaching a tool to the coolant circuit of a cooling unit according to an embodiment of the invention.

Figure 3 shows the inside (directed toward the cooling unit) of details according to Figure 2.

Description of preferred embodiments

Illustrative embodiments of the invention will now be presented with reference to Figures 1 through 3.

Figure 1 shows a complete cooling unit for a welding machine with coolant tank 1, coolant pump 2, cooler 3, a first attachment unit 4, a second alternative attachment unit 5, fan 6 and flow monitor 14. The attachment units have an embodiment of the invention

which is shown more clearly in Figures 2 and 3.

Figure 2 is an attachment unit 4, 5 with supply attachment 7 and return attachment 8 and also a detector unit 9 placed in direct connection to the supply attachment. The resilient detector unit is shown in a position where it has been moved from its rest position in order to provide space for attaching the attachment nipple (not shown) of the tool to the supply attachment. The detector unit has here been provided with a recess matching the tool nipple in order to make it easy to move the detector unit away from its rest position, when it completely or partially covers the opening to the supply attachment, without needing to use more than one hand.

Figure 3 shows the rear face of the attachment unit according to Figure 2, i.e. the face which is directed inward to the cooling unit or the apparatus connected to the latter. The figure shows the detector shaft 10 which supports the detector unit and the spring which gives the detector unit its resilient properties and allows it to rest against the attachment nipple of the tool or the tube so that the angle of rotation is proportional to the nipple/tube diameter and can thus constitute a measure of the cooling output which the attached tool requires. If the cooling requirement is greater, the attachment nipple and/or the tube are thus given greater dimensions.

Measurement of the angle of rotation can be done by a sensor unit (not shown) such as a potentiometer, an optical angle sensor, resolver or the like. The signal from this sensor unit can then be processed in the control device for the cooling output, and the control is thus adapted to the requirement in question. The control can be effected for example by pump and/or fan speed. Instead of measuring the angle of rotation, it

is possible, in a similar manner, to measure how far the nipple projects into the supply and/or return attachment. A large nipple cannot be inserted as far into the attachment as a smaller one. This position can also be measured by resistive, optical or inductive means. In this case, capacitive measurement would be preferable. Nipple and attachment device have been assumed to be made of metal, at least one part having a nonconductive covering layer.

The simplest form of output control consists solely of on/off control. The pump and/or fan is either running or not. For this, only a microswitch 11 is needed as signal sensor. An eccentric detector unit activates the microswitch which sends a signal to the control device to start up the components in the cooling unit. It is sometimes also possible to allow the motor current to the pump to be interrupted directly by a switch directly actuated by the eccentric of the detector unit.

Of course, the invention is not limited to welding machines on which the example has been based, and instead the invention applies within the scope of the patent claims.

PATENT CLAIMS

1. An arrangement (9, 10, 11, 12) for controlling the cooling output from a cooling unit, where said cooling unit is connected to an attachment device (7, 8) for attachment of an attachment nipple belonging to one of several attachable tools intended, upon attachment and during operation, to be cooled from the cooling unit by means of a coolant flowing through the attachment nipple, and where said arrangement (9, 10, 11, 12) is adapted to be connected in signal terms to a control device for the cooling output, characterized in that it is intended to be arranged in and/or in immediate proximity to said attachment device (7, 8), and in that it further comprises, on the one hand, means (9) for detecting the presence or absence of the attachment nipple in the attachment device (7, 8) and, on the other hand, means for generating a signal corresponding to the detection result.

2. The arrangement as claimed in claim 1, where the detecting means can further distinguish a size of the attached attachment nipple or a tubing connected to the latter, and the generating means can further generate a signal corresponding to this size.

3. The arrangement as claimed in claim 1 or 2, where the detecting or generating means comprises a resilient element adapted to rest against the tubing or the attachment nipple when the latter is attached to the attachment device.

4. The arrangement as claimed in claim 3, where the resilient element covers the opening of the

attachment device when no attachment nipple has been attached.

5. The arrangement as claimed in any of claims 2 through 4, where the means for generating the signal comprises a resistive, inductive, capacitive or optic component.

6. The arrangement as claimed in any of claims 2 through 4, where the means for generating the signal comprises an on/off element (11) such as a microswitch.

7. A cooling unit comprising an attachment device for attachment of one of several attachable tools intended, upon attachment, to be cooled from the cooling unit, characterized in that it also comprises an arrangement according to any of claims 1 through 6.

8. An apparatus intended to drive one of several attachable tools, where said tools can have different needs for cooling output, comprising an attachment device for such tools, and further comprising a cooling unit for cooling an attached tool, characterized in that it also comprises an arrangement according to any of claims 1 through 6.

9. A welding machine for electric arc welding, intended to be able to provide one of several attachable welding burners with energy for a welding arc, and connected to, on the one hand, an attachment device for such a welding burner and, on the other hand, a cooling unit intended to be able to provide an attached welding burner with the required cooling output, characterized in that it is also connected to an arrangement according

to any of claims 1 through 6.

10. A wire feeder mechanism for electric arc welding intended to be able to provide one of several attachable welding burners with forwarded welding electrode, and connected, on the one hand, to an attachment device for such a welding burner and, on the other hand, a cooling unit intended to be able to provide an attached welding burner with the required cooling output, characterized in that it is also connected to an arrangement according to any of Claims 1 through 6.

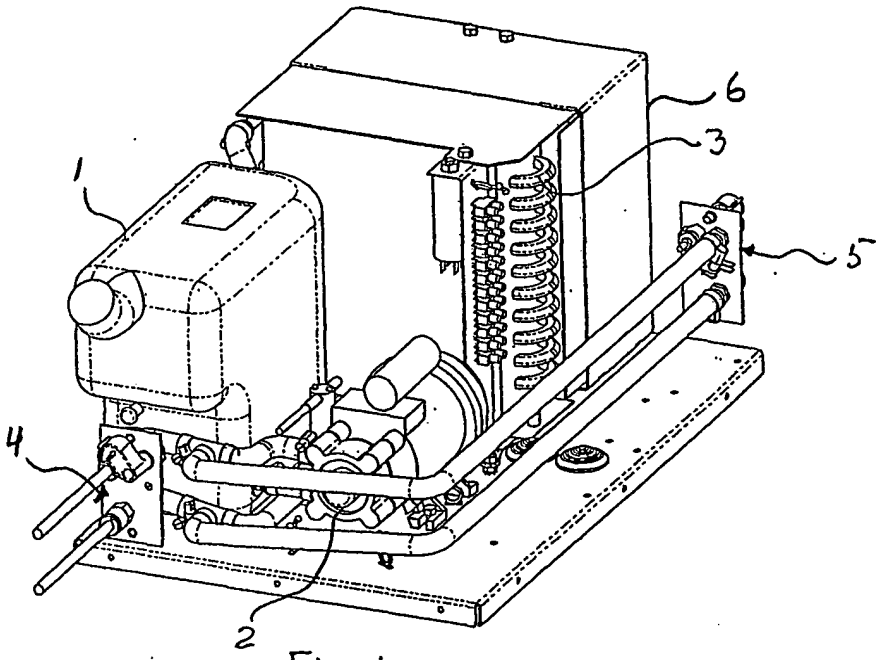

Fig. 1

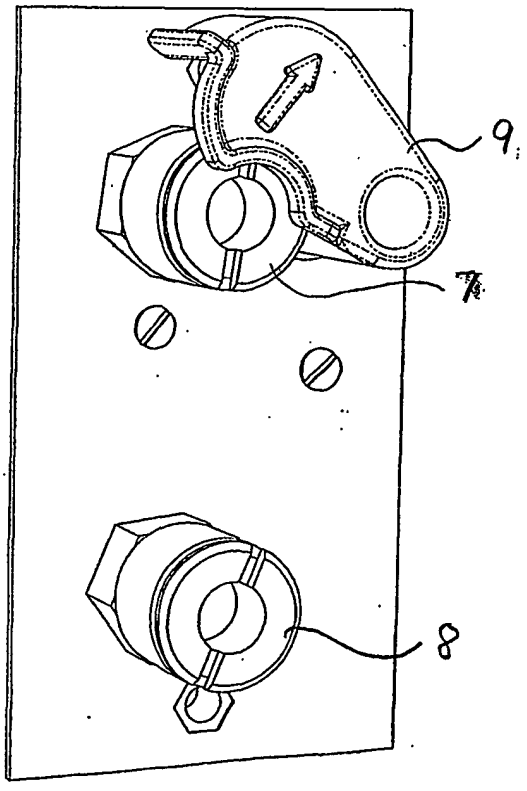

Fig. 2

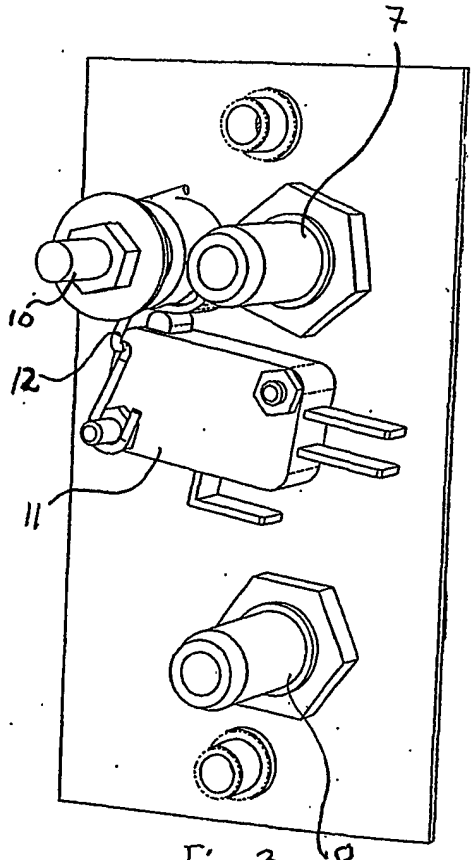

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/02662

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B23K 9/10
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B23K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 0044523 A1 (FRONIUS SCHWEISSMASCHINEN PRODUKTION GMBH & CO), 3 August 2000 (03.08.00) --	1
A	US 5811674 A (PETER MCCORMICK), 22 Sept 1998 (22.09.98) -- --------	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 March 2002	12 -03- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM	Authorized officer Magnus Westöö/mj

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 01/02662

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0044523 A1	03/08/00	AT 10799 A	15/04/00
		AT 407019 B	27/11/00
		AU 2421700 A	18/08/00
US 5811674 A	22/09/98	US 6026682 A	22/02/00
		US 6237408 B	29/05/01
		US 2001032830 A	25/10/01